Proposal from the U.S. Environmental Protection Agency to the North American Communications Environmental Excellence Initiative and the Center for Resource Management

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Summary

To reduce energy use and related greenhouse gas (GHG) emissions from telephony products, the U.S. Environmental Protection Agency (EPA) proposes to the North American Communications Environmental Excellence Initiative (CEEI) and the Center for Resource Management (CRM) the development of an ENERGY STAR® labeling program for cordless phones and answering machines. This program would allow participating manufacturers of these products to affix the ENERGY STAR label denoting superior energy performance on qualifying models. These models would retain their entire current product features and levels of performance.

EPA, CRM, CEEI members, and wall pack and telephone product manufacturers would collaborate on designing specifications for this label. In cordless phones and answering machines, standby losses can come down to as little as 0.5 Wh by reducing losses from operating circuitry when the device is in standby mode, disconnecting unneeded active circuits, and stopping the battery-charging process once batteries are fully charged.

A commitment to reducing standby losses on the part of the telecommunications industry has the potential to reduce energy consumption, energy costs, and carbon emissions in a meaningful way. Short-term success of the program would depend on a strong demand for ENERGY STAR-labeled products from CEEI companies. Long-term success would depend on educating consumers about the opportunity to choose energy-efficient products clearly identified by the label.

I. Action Steps

Developing an ENERGY STAR label is a comprehensive and inclusive process that brings together EPA, manufacturers and suppliers, trade associations, and other interested parties. Manufacturers participate in ENERGY STAR labeling voluntarily and at no cost.

The ENERGY STAR label makes it easy for purchasing officers to acquire efficient products and sell them to clients. Table 1 describes five steps for EPA and industry to follow in developing and implementing an ENERGY STAR labeling program for telephony products.

Table 1 – Action Steps		
Steps	**Roles for CEEI and CRM**	**Role for EPA**
1. Organize Agree to process, bring in suppliers and original equipment manufacturers (OEM)	▪ Establish working group to communicate with EPA ▪ Inform suppliers and OEMs of the decision to purchase and participate in a telephony program	▪ Research the production of a labeling program for cordless phones and answering machines ▪ Use EPA's tested methodology for developing a program
2. Focus Commit to a cordless phone and answering machine program	▪ Provide feedback to proposed specification ▪ Once a specification is established, support it by communicating it to suppliers and OEMs	▪ Create an ENERGY STAR program for cordless phones and answering machines
3. Launch Along with EPA, identify the venues for a high-profile launch	▪ Provide an implementation calendar to suppliers and OEMs ▪ Produce company-specific materials suitable for a high-profile launch ▪ Launch the program	▪ Produce EPA's suite of materials suitable for a high-profile launch ▪ Launch the program
4. Market Market, communicate, and adopt the ENERGY STAR program	▪ Communicate the company's commitment to energy efficiency through a corporate statement ▪ Launch the program internally in each company ▪ Train procurement staff in purchasing ENERGY STAR CP&AM and office equipment	▪ Market the ENERGY STAR label as the national symbol for energy efficiency ▪ Provide procurement information to make it easy to buy ENERGY STAR products ▪ Provide training on ENERGY STAR procurement and purchasing
5. Track Maintain statistics reflecting deployment of the program	▪ Share aggregate sales figures with EPA	▪ Share sales and pollution prevention figures with industry and the public ▪ Continue to market the brand

II. Market Scope and Pollution Prevention Payoff

In 1998, 66 percent of American households had cordless phones and 65 percent had answering machines (K.B. Rosen et al., *Energy Use of Set-top Boxes and Telephony Products in the U.S.*, Draft, Lawrence Berkley National Laboratories, LBNL-45305, March 2000). *Appliance Magazine* (D. Ritchie, "Riding it Out: 48th Annual Appliance Industry Forecast," January 2000) estimates that 20 million telephone answering machines and 42 million cordless phones will be sold in the Unites States in 2000–each one with a wall pack. For simplicity, this paper assumes sales of 62 million units: 31 million cordless phones, 20 million answering machines, and 11 combination cordless phone answering machines. These are collectively referred to as CP&AM.

Because these electronic products have become cheaper to manufacture and buy, the dollar sales figures for cordless phones have reached a plateau, with a slight declining trend. Total dollar sales are expected to fall from $1,540 million in 1998 to about $1,515 million in 2001, although per unit sales are on the rise. Dollar sales of answering machines are expected to fall even faster, from $1,060 million in 1998 to about $960 million in 2001 [MultiMedia Telecommunications Association (MMTA), *1998 MultiMedia Telecommunications Market Review and Forecast*].

Flat unit sales accompanied by decreasing revenue indicate reduced profit margins–a sure sign of a competitive market. The market is also more competitive because price is as important a consideration as features. In such a competitive market, early adopters of energy efficiency will have a lead due to the positive association with an environmentally sound product.

Overall energy-saving potential may be derived from an analysis of CP&AM sales. Table 2 presents the installed base of 199 million units, with 62 million more units entering the market each year. The opportunity lies in changing the production line of these 62 million units.

Table 2. Number of Units, Aggregate Energy Use, Share of U.S. Residential Electricity Use (1999) and Projected 2000 Sales

Product	Number of Units (millions)[a]	National Telephony Energy Use TWh/yr	Share of U.S. Residential Electricity Use[b]	Projected Unit Sales 2000 (millions)[c]
Answering Machines	77	2.1	0.19%	20
Cordless Phones	87	2.4	0.21%	30
Cordless/Answering Machines	35	1.0	0.09%	12
Total U.S.	199	5.5	0.49%	62

[a]Based on 104.2 million U.S. households in 1999 (Rosen et al., 2000)
[b]Based on the 1999 residential electricity consumption of 1,122 TWh (*Annual Energy Outlook,* 2000)
[c] *Appliance Magazine* provides 2000 data for total unit sales (62 million) and for unit sales of cordless phones (42 million) and answering machines (20 million). No 2000 data is available for sales of combined units (cordless phones/answering machines). The Cadmus Group estimated the 2000 sales data for combination units by using the ratios from 1999 data in the following way:

- Projected 2000 sales for cordless phones = 42(.71) =30
- Projected 2000 sales for combination cordless/answering machine units = 42(.29) = 12

Source: Rosen et al. (2000) and The Cadmus Group, Inc.

Estimates of Energy and Greenhouse Gas Emission Savings

If all 62 million products sold in the U.S. market every year were rated at 0.5 watts during standby, over 1.53 TWh could be saved annually (see Table 3). This savings translates into GHG emissions savings (assuming 1.64 lbs. of CO_2 /kWh) of 0.31 MMTCE and a consumer cost savings of 112 million each year.

Table 3 also shows energy waste from current wall packs, losses using improved designs meeting a 0.5-watt specification, along with percent savings over current models.

Table 3. Savings Opportunities

Product	Losses in Current Models[a]	Losses in proposed Models[b]	Savings	Projected Unit Sales 2000[c] (millions)	Potential TWh Saved[d]	MMTCE	$ Million[e]
Answering Machine	27.2 kWh/yr	4.4 kWh/yr	84%	20	0.46	0.09	33.3
Cordless Phone	27.9 kWh/yr	4.6 kWh/yr	83%	30	0.71	0.14	51.5
Combo	35.1 kWh/yr	4.9 kWh/yr	86%	12	0.37	0.07	26.9
Total				**62**	**1.53**	**0.31**	**111.7**

[a] Based on Cadmus estimates from LBNL energy use data
[b] Based on a 0.5 W specification
[c] Million units, Appliance Magazine (1999) with additional Cadmus prorating
[d] If all new products sold complied with 0.5-watt specification
[e] Using the 1999 average cost of residential electricity of $0.073/kWh

Source: The Cadmus Group, Inc.

LBNL estimates that the cumulative savings under this scenario over the course of this decade (2000-2010) can amount to 20.4 TWh and 2.9 MMTCE.

III. A Call to Action

EPA invites CEEI and CRM to host a meeting for members on the development of an ENERGY STAR labeling program. Should industry stakeholders respond favorably, EPA's Climate Policy and Programs Division will work with CRM to establish a joint task force to implement such a program.

ATTACHMENT I. TELEPHONE PRODUCTS AND ENERGY USAGE

A whole-systems approach—consistent with a labeling program—would identify opportunities to increase efficiency in the power supply and the attached cordless phone or answering machine. The use of switch mode power supply (SMPS) technology, circuits that power down the device while it is in standby mode and charging algorithms that eliminate battery overcharge will help maximize pollution prevention. This section discusses where energy is used and wasted, and presents opportunities for improvement.

Energy Consumption

When in use, a standard wired phone taps power from the wall outlet. The energy available through the phone line is not enough to power the features consumers expect in CP&AM, which is why these machines need supplemental power. The energy needs of CP&AM–obtained from wall packs–vary depending on the modes of operation, as shown in Table A-1.

Table A-1. Modes of Common Telephone Products (Answering Machines and Cordless Telephones)

Active	Play	The unit is transmitting telephone signals or playing/recording a message. The unit is expending energy providing services.
Active	Charge	The wall pack is supplying current to the battery to charge it. This modality applies to cordless phones.
Standby	Overcharge	The unit is inactive, the battery is charged, but the wall pack continues to provide energy. This modality applies to cordless phones.
Standby	Idle	The unit is inactive and the battery is not being charged. However, energy is spent powering circuits.
Disconnected		The unit is unplugged.

Source: The Cadmus Group, Inc. from Rosen et al. (2000)

Other than providing about 100-250 mW for light emitting diodes (LEDs) and monitoring circuits, cordless phones and answering machines require very little energy during standby. Based on parts and components available in the market, theoretical standby energy use for CP&AM is around one quarter of a watt. The values are summarized in Table A-2. In an efficient CP&AM design, a 0.5-watt specification can address standby demand plus power supply losses.

A 0.5-watt specification contrasts measured standby power measurements based on test data from Lawrence Berkeley National Laboratory (LBNL) (Rosen et al., 2000). In these measurements, standby load alone can be as much as 5 watts–even if the device is not transmitting a signal or recharging an empty battery–because the power supply and active circuits consume energy.

Table A-2. Energy Use of Cordless Phones and Answering Machines		
Energy Use [c]	**Cordless Phones** [a]	**Answering Machines** [b]
Theoretical Power Requirement in Active/Play Mode	1 watt	2 watts
Theoretical Power Demand during Standby	0.25 watts	0.2 watts
[a]When active, assuming a 100-mW transmission power and a 50-percent efficiency [b]Assuming use of a tape mechanism [c] Wall pack efficiencies not considered		
Source: The Cadmus Group, Inc., Steve Bristow, Consultant		

Challenges and Opportunities

Energy waste in cordless phones can be divided into three components:

1. Losses inherent to the wall pack power supplies
2. Losses from operating circuitry when the device is in standby mode
3. Losses because the wall pack overcharges rechargeable batteries (charge while full)

Answering machines have similar loss patterns but do not have batteries. Therefore, battery overcharging does not apply.

CP&AM waste energy during standby operation because energy efficiency was not a design criteria. Nearly 90 percent of all telephony energy is used during standby, and a large part of that energy is for charging a fully charged battery (Rosen et al. 2000). Table A-3 shows unit energy consumption (UEC) values estimated by LBNL based on unit power consumption (UPC) and usage patterns.

Table A-3. Power, Usage Patterns, and Energy Consumption of Telephony Products

	STANDBY				ACTIVE				
Product	**Idle**		**Charge (when full)**[b]		**Charge (when empty)**[c]		**Active/Play**		**UEC**
	P[a]	**P_t**	**P**	**P_t**	**P**	**P_t**	**P**	**P_t**	**(kWh/yr)**
Answering Machine	3.1	99%					3.6	1%	27.2
Cordless Phone	2.6	35%	3.6	50%	3.6	10%	2.7	5%	27.9
Cordless/Answering Machine	3.1	35%	4.5	50%	4.5	10%	4.2	5%	35.1

[a] Power (P) is measured in watts. P_t is the percentage of time in that mode
[b] *Full* indicates charging that occurs when the battery is already fully charged
[c] *Empty* indicates charging that occurs when the battery is not fully charged

Source: Rosen et al. (2000).

Note that answering machines are idle, yet consuming energy (in standby mode) about 99 percent of the time. Cordless phones are in standby mode about 85 percent of the time (the sum of 50 percent while overcharging and 35 percent while idle). After the user completes a call and the phone is returned to the cradle, the wall pack must recharge the handset batteries. This service is not a primary target for energy savings.

Energy waste can be overcome in the initial design of these devices with circuitry that makes the devices "smart," allowing no more than a minimal flow of electricity except when the device is active.

Opportunities for Energy Savings: Wall Packs Power Supplies

A strategic way to reduce telephone-related energy consumption is to change to highly efficient power supplies. The most promising technology for reducing power supply standby losses comes from switch mode power supplies. This new technology offers opportunities to reduce wasted energy in two ways: reduce standby losses to as little as 0.5 Wh, and stop the battery-charging process once the batteries are fully charged.

With the exception of cellular phone chargers, most telephony products use linear transformers, with no-load losses of greater than 1 watt–compared to SMPS no-load losses under 100mW. Some of the major advantages of SMPS include the following:

- They have reduced weight and size.
- No-load losses are a fraction of standard linear power supply losses.
- They may be used at 110V or 220V.
- They supply cleaner voltage, reducing the need for voltage regulators in the phone.

Using more efficient power supplies does not necessarily maximize pollution prevention; it only reduces losses inherent to the power supply. A simple SMPS attached to today's standard

CP&AM, for example, may draw excess power because the device to which it is attached draws energy needlessly. To maximize savings, the complete product must consume energy below a specified level before it can be considered highly efficient.

Opportunities for Energy Savings: Circuit Design

The CP&AM may require a design update so that the circuits incorporate energy saving features beyond those located on the wall pack. Two design changes are most relevant:

(1) Disengage circuits once the call is complete

(2) Use energy-efficient displays

Opportunities for Energy Savings: Battery Chargers

According to LBNL (Rosen et al., 2000), stand-alone CP&AM operate 50 percent of the time overcharging a full battery, sometimes requiring an extra watt beyond the standby mode. Adding smart chargers to these devices would prevent this energy waste.

Cellular chargers, on the other hand, can “sense” when the battery is fully charged. These devices switch to a “trickle charge” mode, charging the battery only when the charge falls below a certain level.

Wall packs with firmware (smart circuitry) to stop battery overcharge work with nickel-metal-hydride, lithium-ion, and even nickel-cadmium batteries.

Costs

CP&AM manufacturers entering the energy efficiency market using smart wall packs or updated circuitry may face a short-term cost premium. The feasibility of adding smart devices today depends primarily on the cost of shifting procurement patterns and updating upcoming products.

Companies that already manufacture wall packs for the cell phone industry, or have already incorporated circuits to disconnect the machines when users end their calls, will have the market lead initially because they face fewer obstacles.

However, the leading electronics companies continually redesign product concepts and have design to manufacture cycles every 18-24 months. By the year 2002, the ideas presented in this proposal can be incorporated to practically every phone product at no incremental cost to users.